

# SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.  
VOL. XVI. No. 412.

NEW YORK, DECEMBER 26, 1890.

SINGLE COPIES, TEN CENTS.  
\$3.50 PER YEAR, IN ADVANCE.

## INFANT PSYCHOLOGY.

THE study of psychology has had so remarkable a development in recent years, and the standpoint from which it is now approached is so unlike the point of view of older writers on mental philosophy, that the several departments which it now comprises stand in need of separate introductions; and not only are such introductions necessary for purposes of exposition, but their apologetic function, though reduced to a minimum, is still real. The expression "nursery psychologist" no doubt means what its author intended it to mean to some others than himself; and it is desirable that it should be understood by the educated public as a badge of honorable service rather than as a phrase of disparagement and discredit.

No doubt we owe to the rise of the evolution idea something at least of the benefit brought about by what we may call the psychological renaissance of the last twenty-five or thirty years. The breadth of the current conception of psychology is certainly in harmony with the conceptions long ago current in other departments of scientific research; but there is a phase of this broadening of psychological inquiry strikingly brought out only when interpreted in the light of evolution doctrine. This is what we may call the genetic phase, the growth phase. The older idea of the soul was of a fixed substance, with fixed attributes. Knowledge of the soul was immediate in consciousness, and adequate; at least, as adequate as such knowledge could be made. The mind was best understood where best or most fully manifested.

Under such a conception, the man was father of the child. What the adult consciousness discovers in itself is true, and wherein the child lacks it falls short of the true stature of soul life. We must therefore, if we take account of the child-mind at all, interpret it up to the revelations of the man-mind. If the adult consciousness shows the presence of principles not observable in the child consciousness, we must suppose, nevertheless, that they are really present in the child consciousness beyond the reach of our observation. The old argument was this,—and it is not too old to be found in the metaphysics of to-day,—consciousness reveals certain great ideas as simple and original: consequently they must be so. If you do not find them in the child-mind, then you must wait for the child-mind to grow.

The genetic idea reverses all this. Instead of a fixed substance, we have the conception of a growing, developing activity. Instead of beginning with the most elaborate exhibition of this growth and development, we shall find most instruction in the simplest activity that is at the same time

the same activity. Development is a process of involution as well as of evolution, and the elements are hidden under the forms of complexity which they build up. Are there principles in the adult consciousness which do not appear in the child consciousness? Then the adult consciousness must, if possible, be interpreted down to the child consciousness.

Now that this genetic conception has arrived, it is astonishing that it did not arrive sooner. The difference between description and explanation is as old as science itself. What chemist long remained satisfied with a description of the substances found in nature? He was no investigator at all, and his science was not born until he became an analyst. The student of philology is not content with a description, a grammar, of spoken languages: he desiderates their reduction to common vocal elements. But the mental-scientist has called such description science, even when he has had examples of nature's own furnishing around him which would have confirmed or denied the results of mental analysis.

The advantages which we look to infant psychology to furnish are covered by this need of analysis; and the reason that the needed analysis is found here, is that the mind, like all other natural things, grows. This general statement may be put into concrete form under several points, which divide this branch of general psychology from others now recognized.<sup>1</sup>

1. In the first place, the phenomena of the infant consciousness are simple as opposed to reflective; that is, they are the child's presentations or memories simply, not his own observations of them. In the adult consciousness the disturbing influences of inner observation is a matter of notorious moment. It is impossible for me to know exactly what I feel, for the apprehending of it through the attention alters its character. My volition also is a complex thing of alternatives, one of which is my personal pride and self-conscious egotism. But the child's emotion is as spontaneous as a spring. The effects of it in the mental life come out in action, pure and uninfluenced by calculation and duplicity and adult reserve. There is around every one of us a web of convention and prejudice of our own making. Not only do we reflect the social formalities of our environment, and thus lose the distinguishing spontaneities of childhood, becoming in so far all coins of the same mint, but each one of us builds up his own little world of seclusion and formality with himself. We are subject not only to idols of the forum, but to idols also of the den.

The child, on the contrary, has not learned his own im-

<sup>1</sup> Race, animal, abnormal psychology, etc.

portance, his pedigree, his beauty, his social place, his religion, his paternal disgrace; and he has not observed himself through all these and countless other lenses of time, place, and circumstance. He has not yet turned himself into an idol nor the world into a temple; and we can study him apart from the complex accretions which are the later deposits of his self-consciousness.

Perhaps one of the best illustrations we can find of the value of this consideration in the study of the child-mind is seen in the reversion to the child-type occasioned by hypnotism. The signal service of hypnotism, I think, is the demonstration of the intrinsic motor force of an idea. Any idea tends at once, and irresistibly, to realize itself in action. All conventionalities, proprieties, alternatives, hesitations, are swept away, and the developed mind reveals its skeleton structure, so to speak, its composition from re-active elements. But hypnotism need not have been waited for to show this. The patient observation of the movements of a child during his first year would have put it among the safest generalizations of the science of mind. In the absence of alternative considerations, reflections, the child acts, and act it must, on the first suggestion which has the faintest meaning in terms of its feelings of movement.

2. The study of children is generally the only means of testing the truth of our mental analyses. If we decide that a certain complex product is due to a union of certain simpler mental elements, then we may appeal to the proper period of child-life to see it taking place. The range of growth is so enormous from the infant to the adult, and the beginnings of the child's mental life are so low in the scale in the matter of instinctive and mental endowment, that there is hardly a question of analysis now under debate which may not be tested by this method. On the other hand, such confirmation shuts out most conclusively the advocates of irreducibility in cases where the adult consciousness is silent or utters a favorable voice. A good example of such analysis is seen in the distinction between simple consciousness and self-consciousness. Over and over again have systems been built upon the necessary subject-object theory of consciousness; namely, that all subjectivity, or consciousness, necessarily implicates an antithesis between *ego* and *non-ego*. But an example of what is thus denied may be seen upon the floor of any nursery where there is a child less than a year of age.

At this point it is that child psychology is more valuable than the study of forms of the consciousness of animals. The latter never become men, while children do. In studying animals we are always haunted by the fear that the analogy may not hold; that some element essential to the development of the human mind may be entirely wanting. Even in such a question as the localization of the motor functions of the brain, where the analogy is one of comparative anatomy and only secondarily of psychology, the monkey presents analogies with man where dogs do not. But in the study of children we may be always sure that a normal child has in him the promise of a normal man.

The contrast between this branch of psychology and mental pathology also shows points of advantage on the side of the former. In the study of mental disease the mental function as a whole is or may be involved. We are never sure that functional connections and sympathies have not been

developed in the growth of the personality as a whole, which lead to idiosyncrasies in that area of mental activity which seems to be most unaffected. For this reason the application of the logical "method of difference," which consists in observing the change brought about in a phenomenon from the removal of part of its antecedent conditions, cannot be always relied upon.

The same difficulty confronts the student of animal pathology. The indefinite source of error called "shock" is always present. The organs left intact by the disease or the operator sympathize in the sufferings of the organism as a whole; and sometimes temporary loss of function is reported, when time repairs the apparent damage.

In dealing with the child, however, the same advantage of simplicity is secured without the corresponding disadvantage of possible interference of functions. In other words, the simplicity of the child is normal simplicity, while the simplicity of disease or surgery is abnormal simplicity; and the danger of what physicians call "complication" is in the former case entirely ruled out.

3. Again, in the study of the child-mind, we have the added advantage of a corresponding simplicity on the organic side; that is, we are able to take account of the physiological processes at a time when they are relatively simple. I say "relatively simple," for in reality they are enormously complex at birth, and the embryologist pushes his research much further back in the life-history of the organism. But yet they are simple relatively to their complex condition after the formation of habits, motor complexes, brain integrations and associations; in short, after the nervous system has been educated to its whole duty in its living environment. For example: a psychology which holds that we have a "speech faculty," an original mental endowment which is incapable of further reduction, may appeal to the latest physiological research and find organic confirmation, at least as far as a determination of its cerebral apparatus is concerned; but such support for the position is wanting when we return to the brain of the infant. Not only do we fail to find the series of centres into which the organic basis of speech has been divided, but even those of them which we do find have not taken up the function, either alone or together, which they perform when speech is actually realized. In other words, the primary object of each of the various centres involved is not speech, but some other and simpler function; and speech arises from a union of such separate functions.

We accordingly find a development of consciousness keeping pace with the development of the physical organism. The extent of possible analogies between the growth of body and that of mind may thus be estimated from below; and any outstanding facts of the inner life which cannot be reduced to the form of physical analogy (if there be any such facts) get greater prominence and safer estimation.

The advocates of a spiritual theory of mind, therefore, should be quite ready to adopt this method, even from the standpoint of their traditional caution. Certainly they gain nothing by refusing to subject their high beliefs to the tests of conformity to the requirements of this law of the developing manifestation of the mental principle. The sphere of critical discussion will then be limited to places in the development of consciousness where spiritual implications force

themselves upon us. It certainly is as unscientific and unphilosophical to refuse to locate such points and to test such implications by the development hypothesis as it is, on the other hand, to claim a victory for the sensational interpretation of the hypothesis before all such points of apparent spiritual implication have been resolved. If the former attitude is arrogant, the latter is as certainly presumptuous.

4. In observing young children, a more direct application of the experimental method is possible.<sup>1</sup> By "experiment" here, I mean both external and internal experiment. In experimenting on adults great difficulties arise through the fact that re-actions are broken at the centre, and closed again by a conscious voluntary act. The subject hears a sound, identifies it, and presses a button. What goes on between the advent of the incoming nerve process and the discharge of the outgoing nerve process? Something, at any rate, which represents a brain process of great complexity. Now, any thing that fixes this sensori-motor connection or simplifies the central process, in so far gives greater certainty to the results. For this reason, experiments on reflex re-actions are valuable and decisive where similar experiments on voluntary re-actions are uncertain and of doubtful value. The fact that the child consciousness is relatively simple, and so offers a field for more fruitful experiment, has already been illustrated in what was said above as to the value of suggestion in child-life; it is also seen in the mechanical re-actions of an infant to strong stimuli, such as bright colors.<sup>2</sup> Of course, this is the point where originality may be exercised in the devising and executing of experiments. After the subject is a little better developed, new experimentation will be as difficult here as in the other sciences; but at present the simplest phenomena of child life and activity are open to the investigator.

With this inadequate review of the advantages of infant psychology, it is well also to point out the dangers of the abuse of such a branch of inquiry. Such dangers are real. The very simplicity which seems to characterize the life of the child is often extremely misleading, and misleading because the simplicity in question is not typical but idiosyncratic. Mr. Spencer had a large range of facts in view when he made organic development a progression not only in complexity, but also in definiteness; and the distinction between simplicity which indicates mere absence of complexity and that which indicates definiteness of function as well, applies with force to mental growth. Two nervous re-actions may appear equally simple; but one may be an adaptive re-action, and the other inadapative. So a state of infant consciousness may seem to involve no complexity or integration, and yet turn out to represent, by reason of its very simplicity and definiteness, a mass of individual or race experience. In other words, children differ most remarkably in the early manifestations of their conscious lives. It is never safe, except under the qualification mentioned below, to say, "This child did, consequently all children must." The most we can usually say in observing single infants is, "This child did, consequently another child may." Yet the uncertainties of the case may be summed up and avoided if certain principles of mental development are kept in view.

<sup>1</sup> On the nature and application of experiment in psychology, see my *Handbook of Psychology, Senses and Intellect*, 2d ed., pp. 25-31.

<sup>2</sup> See the writer's note in *Science*, Oct. 31, 1890, p. 247.

(1) In the first place, we can fix no absolute time in the history of the mind at which a certain mental function takes its rise. The observations, now quite extensively recorded, and sometimes quoted as showing that the first year, or the second year, etc., brings such and such development, tend, on the contrary, to show that such divisions do not hold in any strict sense. Like any organic growth, the nervous system may develop faster under more favorable conditions, or more slowly under less favorable; and the growth of mental faculty is largely dependent upon such organic growth. Only in broad outline and by the widest generalization can such epochs be marked off at all.

(2) The possibility of the occurrence of a mental phenomenon must be distinguished from its necessity. The occurrence of a single clearly observed event is decisive only against the theory according to which its occurrence under the given conditions may not occur; that is, the cause of the event is proved not to lie among agencies or conditions which are absent. For example: the very early adaptive movements of the infant in receiving its food cannot be due to volition, but as to what may account for them the case is still open. It is well to emphasize the fact that one case may be decisive in overthrowing a theory, but the conditions are seldom simple enough to make it decisive in establishing a theory.

(3) It follows from the principle of growth itself that the order of development of the mental functions is constant, and normally free from idiosyncrasy: consequently the most fruitful observations of children are those which show that such a function was present before another could be observed. The complexity becomes finally so remarkable that there seems to be no before or after at all in mental things, and, if child processes show stages in which any element is clearly absent, we have at once light upon the law of growth. For example: if a single case is conclusively established of a child's drawing an inference before it begins to use words or significant vocal sounds, the one case is as good as a thousand to show that thought develops to a degree independently of spoken language.

(4) While the most direct results are acquired by systematic experiments with a given point in view, still general observations kept regularly, and carefully recorded, are important for the interpretation of a great many such records may ultimately afford. In the multitude of experiences here, as everywhere, there is strength. Such observations should cover every thing about the child,—his movements, cries, impulses, sleep, dreams, personal preferences, muscular efforts, attempts at expression, etc.,—and should be recorded in a regular day-book at the time of occurrence. What is important and what is not, is, of course, something to be learned; and it is extremely desirable that any one contemplating such observations should acquaint himself beforehand with the principles of general psychology and physiology, especially the former.

J. MARK BALDWIN.

#### THE INTERMARRIAGE OF THE DEAF, AND THEIR EDUCATION.

In his valuable article on the above topic in *Science*, Nov. 28, Dr. E. M. Gallaudet erroneously states, that, in considering the intermarriage of the deaf, the "important fact has been overlooked . . . that with a large proportion of persons

commonly spoken of as 'deaf-mutes' there is no more likelihood of giving the legacy of deafness to offspring than with perfectly normal people." That fact was pressed in my article to which the doctor alludes, and, as he plainly shows, has been admitted by Dr. Bell. Dr. Bell's classification is doubtless the most philosophic of any yet promulgated, but whether it will be sustained by future investigations remains to be seen. Science is progressive because of the ascertainment of new truths. Its history shows us that the science of to-day may not be accepted as the science of to-morrow. It is too soon to predicate any positive theories upon the statistics as yet collected. The time during which they have been collated is too short, and their accuracy too unreliable (some being merely hypothetical, and many furnished by indiscriminating parties), to warrant deducing positive opinions from them, or the enunciation of any general law based upon them. The investigations of Dr. E. A. Fay, now in prosecution, will no doubt be of greater value than any preceding.

It is scarcely half a score of years since a really intelligent movement in this direction was inaugurated by Dr. Alexander Graham Bell, a philanthropist as well as an eminent scientist and inventor. Statistics relative to the deaf had been taken previously, to some extent, in several institutions, but the inquiries for them had not been general. Statistics, supposed to be reliable at the time of taking them, were by subsequent inquiries, which developed new or additional facts, materially changed; so that former deductions were necessarily reviewed and discarded. One man's lifetime is too short, and his observations too limited, to furnish data upon which to predicate the formulation of a general law. Dr. Bell may have discovered a law governing the offspring of the congenitally deaf persons, or he may have formed an assumption. I think there is as much evidence going to show that an inherent predisposition to deafness exists in some families (using this term in its extended sense), but that it expends its force in a particular line while it remains in others, as there is to show that it perpetuates itself from parent to child. Within my observation there have been more cases of deafness among children only one of whose parents was congenitally deaf than among those both of whose parents were congenitally deaf. I am not certain but that the percentage of the former would also be found less if careful investigation was made. Statistics could be so presented as to show that the intermarriage of the deaf tends to reduce the number of deaf children more effectually than for the congenitally deaf to marry the hearing, or persons whose deafness was acquired after birth, since by the latter means there is more probability of scattering the infirmity than there is in intensifying the predisposition to it by the former. It is undeniable that this predisposition is not obliterated by marriage with one who has it not: hence Dr. Gallaudet's ideal marriage of the congenitally deaf with the hearing, or Dr. Bell's suggestion that they marry the non-congenitally deaf, if there is any truth in the law of heredity, will most tend to increase the number of the deaf; because, where two persons in whom inheres the probability of having deaf offspring intermarry, there can result only one family of deaf children, whereas, if they marry hearing or non-congenitally deaf persons, two such families may result.

If the congenital deaf-mute must have so much solicitude for his offspring as Dr. Bell and Dr. Gallaudet insist on, shall the hearing person or the non-congenital deaf have none for his? The deaf man or woman has the same right to

exercise his judgment in the selection of a partner for life that any other person has. If they desire to compare their family histories with reference to inherent predisposition to deafness, I know of no one who could object, or of no reason why they should not do so, and not as much as that they and all others should consider a phthisical, scrofulous, or cancerous family diathesis. Dr. Gallaudet's argument with reference to the marriage of the deaf with the hearing is good, but is quite as forceful on the other side of the question. Both parties to a marriage have an equal right to forecast the future. No one will deny that a family where one parent is deaf suffers greater disadvantage than one where both parents can hear. Unless there is sincere love between the parties, the hearing person will not enter into such a marriage. A question of this kind is not to be considered from the standpoint of the deaf alone.

After considering Dr. Gallaudet's objection, I still maintain, that, for those deaf persons who improve the opportunities afforded them under the genius of our civilization, deafness may properly be termed only a serious inconvenience. The term "misfortune" is indefinite, and may imply little or much. The loss of an arm is a misfortune, and so is the loss of a finger. I know of no one who says deafness is not a misfortune. My statement to which the doctor objects was to the effect that what was once a calamity (a very strong term) is now only a serious inconvenience. I suppose, as Dr. Gallaudet objects to this, that he uses the term "grave misfortune" in the sense of a calamity. It may or may not be such, according to circumstances. I have known instances in which the visitation of deafness proved to be a stroke of good fortune. I decidedly protest against forever holding up the deaf as victims of a terrible misfortune, and objects of commiseration and charity, after an intelligent public has, at enormous expense, made elaborate, and in some cases palatial, provision for their education, mental, moral, and manual, and while it continues a generous annual outlay for the prosecution of this good and necessary work; and especially do I object to impressing on the deaf themselves, as Dr. Gallaudet's article is calculated to do, that the time is never to come when they shall cease to belong to a special class who are to be looked after by others. I deem it wiser to instill into them the idea that they stand upon the same plane as others, and must provide for themselves as others do; and that, being handicapped with the inconvenience of deafness, they must expect to do a little better than others do in similar walks of life, and thus make themselves desirable to employers. I regard this as one of the important duties of a teacher of the deaf, and of none more emphatically than of one who stands at the head of a college for the deaf, where the choicest spirits and minds culled from a continent are assembled. Surely the public expects this, when the various States and the general government expend more than ten million dollars for buildings and grounds for the accommodation, comfort, and pleasure of the youthful deaf while securing their education, and annually expend a million and a half dollars for their instruction and maintenance. The traveller in European countries beholds palaces erected by public moneys for kings, princes, and prelates; but it is one of the crowning glories of America that our grand structures are mostly for humanitarian and educational purposes, which enlighten and elevate the common people. Prominent among these are some for the deaf, not to make them a pampered and favored class, but to fit them for an equal chance in life. In many cases this is done to such an extent that they distance their hearing relatives,

and, from being a dependence, they become the comfort and stay of aged parents and other needy relatives; so that I said I have known some instances where the visitation of deafness was a stroke of good fortune. When I see a lad, solely because of his deafness, taken by kind hands from a home of poverty; transported to an elegant institution where every want is anticipated, both in health and in sickness; for years clothed as comfortably and fed as healthfully as the children of opulence; favored with most skilful instructors and kind care-takers; given books and all school supplies; taught a good mechanical pursuit; graduated with honor; then taken to college, where for a term of years he is given a course of study as thorough as hearing persons receive and pay for in the best colleges; again graduated with honor; without a day's waiting or search inducted into a lucrative position and an honorable profession; having for these great benefits paid nothing, either himself or his relatives for him (and I consider, that, had he retained his hearing, a life of drudgery would as certainly have been his as it has been of the other members of his family),—I plainly see that deafness to him, though always a serious inconvenience, was a stroke of good fortune.

When I see the deaf daughter of a widow in poverty, after receiving her education, from her earnings purchase a home in which she maintains her mother, lends a helping hand to the other children, and lives for many years in the confidence and regard of refined people, I inquire, though always a serious inconvenience, where is the "grave misfortune" that deafness brought either to this lady or her friends, especially since older brothers and sisters do not half so much; and it is morally certain that she would not but for the excellent training she received because of her deafness. When a finely educated young man who never heard, tells me, in answer to my inquiry as to how much he laments his deafness, "Not at all," and adds in reply to further inquiries, "Because, so far as I can now see, had I been able to hear, I should have continued to live in the same low plane I was taken from, and in which my brothers, whom I dearly love, still live, but with whom I would not exchange conditions," though a serious inconvenience, I do not see in this visitation of deafness a calamity or even a "grave misfortune." When I see a lady congenitally deaf in her neat, tasty, well-kept, and well-ordered home, with walls decorated with drawings and paintings the work of her own skilful hands,—a happy mother, having on her lap a lovely child, which she is teaching to speak the utterances a devoted teacher years ago taught her,—and responding to the appeals of a hearing brother for financial aid to support his family, I inwardly ask myself, though always a serious inconvenience, where is the "grave misfortune" in the case of this person, whom I have repeatedly known to express thankfulness for her deafness in the days of her maidenhood?

A mother who had left with me child after child till four of her deaf children were under my care, once unburdened her heart to me, and complained bitterly of the hard Providence that had inflicted this calamity on her family, but added, "I have one son who hears: he is the apple of my eye and the pride of my life. I shall have great comfort in him." Years passed away. The deaf children completed their education, and were settled in life, when this same mother reminded me of the former conversation, and added, "I wish ——— had been deaf also: he has made me more trouble than all my deaf children together. If he had been deaf, he would have been under your training, as the others were, and would have been a good man." These are not

hypothetical cases, but actual facts, to which there are many others similar. I doubt not all superintendents of institutions for the deaf have seen parallels. It may be urged that these and similar ones are exceptional cases. Grant that they are. All of them at the first were beset with very discouraging prospects. If, in spite of such unfavorable environments, these could rise superior to them, why should the deaf with more favorable conditions be taunted or tortured with the suggestion of grave misfortune? They do not seem so to regard one another. One would suppose that if sympathy for "a brother in distress" would anywhere call forth kindly reception and encouragement, it would be at a college where the subjects of "grave misfortune" are assembled. But to our surprise we find that these frolicsome lads "haze" the new-comers in a style that, while it might not do discredit to a Comanche Indian, certainly does no credit to themselves or their college.

There is a limit to the obligation society owes to its members who start at a disadvantage on the race of life, but just what the limit is has not yet been clearly defined. For the deaf, provision is made for ten years' care, keeping, and instruction by the State governments, and for a college course of from four to six years by the United States Government, to which it is now seriously proposed to add a normal school for the training of teachers. A home for the aged deaf has already been established in one section of the country, which is a most worthy enterprise, and is doing a very humane work. With the school and the college at one end of life, and the home at the other, it would seem that the limit must be nearly attained. But when the normal school is established, it is but a step further to provide an asylum where the intervening years of life may be passed, as is being arranged for the blind. That may be very well for the blind, but I would have no hesitation in denouncing any such project for the deaf as subversive of their best interest and manliness. No one, so far as I know, has seriously proposed such a provision for the deaf (though the inquiry has been made of me as to its practicability), but only a few years ago no one had proposed it for the blind. The tendency seems to be in that direction, and it is about time to call a halt. A "grave misfortune" can be used to plead for a large amount of charity.

Dr. Gallaudet adopts a common fallacy when he states that "all deaf children have the organs of speech." That they have the organ of voice is true, but voice is not speech. The organ of voice is one thing, the organ of hearing is another, but the organ of speech is the union of the two. Speech is the result of the intelligent combined use of the organ of voice and the organ of hearing in a healthy condition. Deaf-mutes have not the important organ of hearing, and, for this cause alone, have not speech. There is no speech of any race, tribe, or clan of men, however barbarous or cultured, that is not based upon hearing; so that we may say the organ of hearing is as essential for speech as the organ of voice. The two are the physical complements of each other in the production of speech. But there is a third element, not physical, necessary for speech; namely, intelligence. This the deaf-mute has perfectly. Nightingales, mocking-birds, and larks have voices that the sweetest and most renowned cantatrices have endeavored to rival in vain. Lions have voices that the basso of the grand opera has never approached. All these and many others of the lower animals have, in addition to voice, the sense of hearing more acute than has ever been known in man; but they have not intelligence sufficient to so use these gifts as to produce

speech. If it be urged that their vocal organs are not suited to formulate speech, I reply that idiots have perfect human organs of voice and hearing, but have not speech for the same reason that lower animals have not,—the want of intelligence. Not only are the organ of voice and the organ of hearing, with intelligence, necessary for speech, but they must be in a healthy condition, even to maintain perfect speech after it has been acquired. This is plainly shown by a fact noticed by every observant person, that individuals whose auditory apparatus becomes impaired (though the vocal chords remain in good condition) in middle life, after speech has been fully acquired, and possibly several languages mastered, suffer deterioration of their speech, despite the greatest watchfulness of themselves and their friend. Hearing is a constant monitor, correcting the errors of enunciation, as conscience is, correcting wrong impulses and acts. As surely as searing of the latter results in debasement of the moral life, so surely the failure of the former results in deterioration of speech. If it is difficult for one who once heard perfectly and spoke fluently to retain exactness of utterance with impaired hearing, how much more difficult it must be for one who never enjoyed the advantages of the hearing sense to acquire speech! Yet some do this to a limited degree: but they are marvels of ingenuity and perseverance on the part of their teachers as well as of themselves. It may be safely asserted that no more difficult task can be assigned to mortals than to effect this. To teachers it is a most exhaustive and death-dealing process, when followed up with cases not specially gifted with an unusual aptitude not readily accounted for. Such cases are rare and exceedingly interesting; much more rare than Dr. Gallaudet's admission that "all, or nearly all, deaf children can be taught to speak; but this is precisely as all, or nearly all, normal children can be taught to sing." This is not at all a just comparison, if the doctor means speech intelligible to general society. Congenitally deaf persons who readily use speech are more nearly analogous in number and production to good poets than to singers. "Poeta nascitur non fit" is a universally accepted adage, whose underlying principle may well be applied to good users of speech who never heard. These statements are made in a spirit of the utmost friendliness to the instruction of such deaf persons in articulation as can acquire it, and are willing to make the necessary effort to that end, and after more than twenty years of earnest labor in this work, in which I have seen more than one faithful teacher give up life as a martyr to it, and after placing a thousand pupils in classes for such instruction, and now having two hundred engaged in it. I have met some very gratifying results, but have experienced many disappointments. This was especially true in my first endeavors in articulation work, for I had not then learned that many deaf children who can easily be taught to utter elementary sounds, and associate them with letters, symbols, and diacritical marks, are completely frustrated when they come to use them in combination, and in the intricacies of continuous speech, with punctuation, intonation, and inflection, which give to speech for those who hear its musical quality and pleasurable effect, but of which the congenital deaf-mute has no conception. Speech in a monotone would be very insipid to those who hear, but for the deaf person it has not even a monotone.

Dr. Gallaudet's statements, in his excellent article upon the proper place for the sign-language in the education of the deaf, are so just and true, and the authorities he cites are so reliable and conclusive, as to leave no demand for

further urging that point. But in *Science* of Oct. 17, Mr. B. Engelsman, speaking upon the nature of the sign language, so egregiously blunders in the statement that one is not able to express or receive abstract ideas through the medium of the sign-language, that I am forced to believe, upon the hypothesis that he is a truthful man, that he knows nothing about it, though the temerity of such a procedure, if not admirable, is certainly astounding. It may be safely assumed that two intelligent, well-educated persons, each having an accurate knowledge of two languages, will, in their daily intercourse with each other, use the one which best suits their purpose and expresses their thought with most precision. I now have in mind two gentlemen, one of whom lost his hearing at six years of age, the other at twelve. Each had good use of speech before becoming deaf, and has retained it. Both have received excellent educations, having mastered the literature of several languages, ancient and modern, and also the mathematics and metaphysics of a college course; yet in their daily association, which I have closely observed for years, they invariably use the sign-language, notwithstanding both would be considered good speakers for deaf persons. In answer to my inquiry, one of them says, "I do not use lip-reading or vocal utterance at all when I meet very well educated semi-mutes. I consider such a method a bore." The other of these gentlemen, in reply to the same inquiry, says, in view of his own experience, "Between two deaf persons, sign-making, interspersed with finger-spelling, is by far the easiest, readiest, and most satisfactory medium of conversation that man can devise. This mode of conversation is extremely delightful to me. I use in written conversation English, German, and French. By means of signs I can have a discourse addressed to me in philosophy, history, literature, science, theology, or any other topic, and can reproduce it very fully in writing." I know this to be true; for I have repeatedly known him to take notes of my unwritten addresses given in the sign-language, and afterwards furnish them for publication without the omission of a thought, and in better language than I could have expressed it myself, or than was in my mind at the time of delivery. I inquired of a deaf friend whose wife as well as himself has been taught articulation, and is a most acute lip-reader, how much they use speech and lip-reading together. His reply was, "In asking me if I habitually converse with my wife by means of lip-reading, you might as well ask me if we walk down town together on our hands. We do relatively as much lip-reading as that kind of walking." A very intelligent gentleman, living in the city of Chicago, whose wife as well as himself is a semi-mute, one having lost hearing at seven, the other at thirteen, years of age, and both while at the institution having received careful instruction in vocal utterance and lip reading, says, in answer to my inquiry, "Mrs. G. and I never carry on articulation with each other." He goes on to say, "As supplementary information, I may add, that, of the many semi-mutes in the city from the various schools of the country, only three of the whole number are known to use articulation as a sole and constant means of communication with hearing people." A lady congenitally deaf, who is unusually expert in the use of speech, whose husband is a semi-mute and speaks well, replies, "My husband and I use vocal utterance in our daily conversation a great deal, almost half as much as the sign-language. At meal-time we use our voices in such expressions as 'Please pass the bread,' 'Pass the butter, if you please,' etc., in short sentences; but when we talk at length, we have to use the sign-language, as it is quicker. I have



always felt so thankful for all you have done in teaching me to talk. It gives us great pleasure to talk to our precious little boy. He understands if I say 'Baby, don't,' when he pulls my hair. He can say 'papa,' is six months old, and weighs twenty pounds." This last is one of those exceptional cases, which we earnestly wish were more numerous among congenital deaf-mutes; that sometimes reward the long patient labor and ingenuity of the teacher. Among hundreds, I have found but few such. It will be noticed that even in this case, where there is both a disposition and an effort to make the most of her acquired speech, signs are necessary to supplement the best she can do with vocal utterance. I have refrained from an expression of opinion on this subject, preferring to give the testimony of persons who are unquestionably competent. The statements quoted were given without the knowledge of the use I should make of them. In view of such testimony, how any honest person can say that the sign-language is incapable of the expression of thought and abstract ideas is incomprehensible. I have never known an individual who endeavored to acquire this language to make such a statement. Even Mr. Engelsman, if he had witnessed at the Convention of American Instructors of the Deaf last summer, as many others did, the translation into the sign-language of the philosophical essay by Mrs. Alice Noyes Smith, simultaneously and concurrently with its reading by its author, would have pronounced it a marvel of exactness, force, and beauty. The sign-language is with that lady vernacular, as she was born and reared with the deaf. Added to this, she has enjoyed the training of her father, Dr. J. L. Noyes, superintendent of the Minnesota Institution for the Deaf, who is, I think, the one most discriminating, critical, and precise master of its language. Mrs. Smith stated that to her this language had all the ease, elegance, and force of spoken language.

In July, 1889, there assembled in the city of Paris, France, a world's congress of the deaf, to consider subjects relating to the welfare of their class, and take such action as might seem to be promotive thereof. This congress was the first of its kind. Its members comprised delegates from France, America, Belgium, England, Ireland, Australia, Sweden, Switzerland, Germany, Poland, and Turkey. They also represented all methods of instructing the deaf, in each of which some of them had received their education. If any company of persons could be expected to speak earnestly and frankly on subjects pertaining to the deaf, it would surely be such a one as this congress. The congress remained in session one week, discussing various questions pertaining to their class. At its conclusion the following preamble and resolutions were unanimously adopted:—

"Whereas the Milan Congress, sitting in solemn conclave, had decided that all deaf-mutes could be taught to speak, and that the pure oral system was superior to all others; whereas, under the influence excited by so august and important a body, changes have been made in some institutions which have a strong bearing on the immediate and future welfare of the deaf; whereas we, though we believe in the utility of the oral system to a certain extent, know that the conclusions arrived at by said congress are arbitrary and unwarranted by experience and facts: resolved, that the system known as the American combined system, which approves of the use of both articulation and signs as the only means by which the greatest number of the deaf can be reached, and the greatest amount of good done, is the best; that we deprecate all such arrangements as aim at the introduction of the oral system in its purest form, and the consequent

exclusion of deaf-mute teachers, who have proved themselves fitted for the position; that the above be published to the world as the sentiments of the deaf-mutes gathered from all nations, in the congress held at Paris, July 11–18, 1889."

Such evidence as this is not to be lightly esteemed. It should be duly considered that *for* the deaf-mute there is no such thing as articulation, though there is articulation *by* the deaf; for, while he may utter distinct articulate sounds for others to receive, he cannot receive them himself, and is consequently thrown back upon the visible movements of the superficial parts of the organs of voice, which are chiefly the lips. Some mouths are so constructed that many of the movements of the tongue and teeth can also be perceived, but this is by no means frequently the case: hence what is so often spoken of as articulation, and is really such to the hearing, is only a lip-sign to the deaf; and there arises the question, which is better,—the small indistinct signs formed by the lips, which represent nothing but sounds, which have no existence for the deaf, or the large, rapid, concise, and ideographic signs made by the hands and arms? Which the preference of the deaf is, need not be asked; for it is universally the fact, and notorious, that deaf-mutes who have been taught by the lip method, and have been shielded from the "contaminating influence of signs" (!) more closely than they have from disease, when opportunity offers, take to signs as naturally as ducklets to the water. They are usually such adepts in the sign-language, that it is obvious to the discriminating observer that they are "old hands at the bellows." It would be as sensible to tell a rustic to blear his eyes on Broadway, or a boy to blear his at the circus, or a belle to wear dark goggles in a millinery-store, as to inhibit the deaf-mute using signs when he meets other deaf-mutes, if he has something to narrate. When fish will not swim in the water, and birds will not fly in the air, we may expect the deaf-mute to disuse signs as a means of interchange of thought. These statements are not made because of objection or opposition to teaching deaf-mutes to articulate or to read lip signs, for to some of them this ability is at times very useful. I have one of the largest companies of deaf-mutes in the world, receiving such instruction, and I purpose maintaining it in the future as I have done for more than twenty years, during which time I have assigned a thousand of them to teachers for such training. These facts are here set forth that justice may be done the deaf, of whom complaint is often made that they do not do better, by persons who fail to duly appreciate the difficulties they encounter. It should not be a wonder that they do no better, but that they do so well.

PHILIP G. GILLET.

#### NOTES AND NEWS.

*Symons's Meteorological Magazine* for November contains a climatological table for the British Empire for 1889. The highest temperature in the shade was 109°, at Adelaide, on Jan. 13. For five years Adelaide has recorded the highest temperature in the shade, reaching 112.4° in 1886. It had also the highest temperature in the sun, 170.7°, and was the driest station during the year, having a mean humidity of 63 per cent. The lowest shade temperature was recorded at Winnipeg, on Feb. 23,—42.6°. Only once does any other station come within twenty degrees of it. It had also the greatest range in the year, the greatest mean daily range (24.5°), the lowest mean temperature, and the least rainfall (14.95 inches). The highest mean temperature was 80.5°, at Bombay; and the greatest rainfall, 73.79 inches, at Trinidad. London was the most cloudy and the dampest station, the mean humidity being 81 per cent. The brightest station was Malta, which had little more than half the cloud of London.

## SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada.....\$3.50 a year.  
Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XVI. NEW YORK, DECEMBER 26, 1890. No. 412.

## CONTENTS:

|  |   |
|--|---|
| INFANT PSYCHOLOGY<br>J. Mark Baldwin 351                                       | Snake Hill, N. J., as a Locality<br>for Minerals. E. W. Perry.... 360 |
| THE INTERMARRIAGE OF THE DEAF,<br>AND THEIR EDUCATION<br>Philip G. Gillett 353 | Color-Changes in Toads<br>Frederic Gardner, Jun. 361                  |
| NOTES AND NEWS..... 357  | The Cause of Rain<br>Franz A. Velschow 361                            |
| LETTERS TO THE EDITOR.   | BOOK-REVIEWS.   |
| Deaf-Mutes. A. Graham Bell... 358  | A Treatise on Electro-Metallurgy 361                                  |
| The Geology of Quebec City<br>R. W. Ellis; A. R. C. Selwyn 359                 | Outings at Odd Times..... 361   |
| Study of the Surface-Markings of<br>the Planets in 1890<br>Wm. W. Payne 360    | Dust and its Dangers..... 361   |
|  | AMONG THE PUBLISHERS..... 362   |

## LETTERS TO THE EDITOR.

\*.\* Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

## Deaf-Mutes.

I CANNOT agree with Dr. Gillett that it is not a very great calamity to have a deaf and dumb child. Still less can I agree with him that the deafness is no calamity to the child, but "only a serious inconvenience," as baldness is an inconvenience "in fly-time or cold weather" (*Science*, Oct. 31, p. 249).

President Gallaudet dissents from such a view (*Science*, Nov. 28, p. 295), and the deaf themselves will surely not indorse it. The American public also, by their appropriations in aid of schools for the deaf, have expressed a very different opinion. The average *per capita* granted for the education of hearing children is less than twenty dollars per annum, whereas in the case of the deaf it exceeds two hundred dollars.

Dr. Gillett says (*Science*, Oct. 31, p. 248), "Not two per cent of the deaf and dumb are the children of deaf parents." But, if the percentage comes anywhere near that figure, the education of these children alone would cost about one million of dollars. The number of deaf-mutes reported in the census of 1880 was 33,878, and two per cent of this number is 677. At \$200 a head, the cost

of education would be \$135,400 per annum, or \$1,083,200 if instruction were continued for eight years.

"Two per cent" may seem a very small matter to unreflective minds, but a little consideration will dispel the illusion. Not one per cent, not even one in a thousand, of the general population, is deaf and dumb. In 1880 the percentage was 0.0675; in other words, there were 675 deaf-mutes to every million of the population. Dr. Gillett's "two per cent" means 20,000 to the million, a proportion nearly thirty times as great.

Nor must it be forgotten that Dr. Gillett's percentage is taken upon the whole of the deaf-mute population (which, of course, includes children and unmarried adults), whereas the deaf offspring are the products of the married couples alone.

Indeed, as President Gallaudet points out (*Science*, Nov. 28, p. 295), they are chiefly the offspring of couples in which one or both of the parties were born deaf, or came from families containing more than one deaf-mute. Sporadic deafness (if not congenital) is rarely inherited, and the majority of the marriages of the deaf are free from deaf offspring. How prolific of deaf offspring the remaining marriages must be, if their children alone constitute a percentage of the whole deaf-mute population nearly thirty times as great as the normal percentage for the country!

Dr. Gillett informs us (*Facts and Opinions*, pp. 53-58), that, of 1,886 deaf-mutes who had been admitted to his institution, 293 were known to have married (his statistics included the children then in school). Of this number, 272, or more than 92 per cent, married deaf-mutes; and 21, or less than 8 per cent, married hearing persons. We are not told how many families were formed by these pupils; but, as we know that in the vast majority of cases deaf-mutes choose partners who were educated in the same school with themselves, we may safely infer that the families formed by these pupils were very much less in number than the figures would at first sight indicate. If none of these deaf-mutes married pupils of other schools, then the 272 cases alluded to above formed only 136 families. The true number, however, is probably somewhat greater.

Dr. Gillett says (*Facts and Opinions*, p. 57), "These marriages have been as fruitful in offspring as the average of marriages in society at large, some of them resulting in large families of children. It is interesting to know that among all these only sixteen have deaf-mute children." He seems to be unconscious of the fact, that, if you take an equal number of marriages of hearing people, there should not be one deaf child among the offspring (in 1880 there was one deaf-mute for every 1,480 of the general population).

"Only sixteen,"—this expression unfortunately is ambiguous. Does he mean that there were only sixteen deaf children, or did only sixteen of his pupils have deaf children, or were only sixteen of the families formed by the pupils productive of deaf offspring?

In this latter case, how many families were there,—272, or 136?—and how many deaf children? And what percentage of the offspring were deaf, and what hearing? All he tells us concerning this important point is, "In some of the families having a deaf child there are other children who hear."

We are not told in how many of these cases the parents were born deaf, or belonged to families containing more than one deaf-mute, nor how many of the marriages included a congenitally deaf partner.

What I, as a student of heredity, would specially like to know is this: what percentage of the children were deaf in those cases where the married partners were both deaf from birth, and in those cases where both had deaf relatives? I am sure, that if Dr. Gillett will make the calculation, and apply the results to the deaf population of the country, he will realize, as I do, that the question of intermarriage is one that deserves more serious consideration than he has given it in his letter to *Science*.

While, on the one hand, Dr. Gillett does not think it matters much to a child whether he is born deaf or hearing, because "deafness is neither a crime nor a disgrace, nor entails suffering," and because it is so little of a calamity as to be "only a serious inconvenience," like baldness in fly-time, on the other hand, he advocates the intermarriage of deaf-mutes without regard to heredity, because deafness is so great a calamity as to cut them off from



almost every thing in life worth living for — excepting marriage with one another. "Shut out," he says, "from church privileges, as preaching of the Word, prayer-meetings, socials, receptions, lectures, concerts, parties, what remains to them of all that makes life pleasurable to us? . . . To forbid them, as some would, matrimony, the one remaining but most helpful and enjoyable of all social and family relations, is a monstrous cruelty with very little reason" (*Science*, Oct. 31, p. 248).

But Dr. Gillett need not feel disturbed about this matter. Neither I, nor any one else, so far as I know, proposes to practise this cruelty upon the deaf. My position upon this subject is substantially that taken by President Gallaudet (*Science*, Nov. 28, p. 295). I thoroughly agree with him in all he has said concerning intermarriage, and thoroughly disagree with the rest of his article.

Dr. Gillett advocates intermarriage because the affliction is so great, and ignores heredity because it is so slight. President Gallaudet's position is, I think, equally inconsistent. He advocates a certain system of education, while at the same time he deprecates its results. Segregation and the sign-language are the chief causes that have led to the intermarriages of the deaf and dumb. He advocates the causes, while he deplores the result. I may have more to say upon this subject at some future time.

ALEXANDER GRAHAM BELL.

Bellevue Brough, C.B., Dec. 10.

### The Geology of Quebec City.

IN reference to the geology of Quebec, I can only say that practically the discussion of the citadel rocks has at present passed into the hands of the paleontologist. There is nothing conclusive in the stratigraphy of the region itself to show their exact horizon. They are bounded on all sides by faults of great extent, by which they are brought into contact with rocks of Silly (Upper Cambrian) age on the mainland above Quebec City, with rocks of Levis (Lower Silurian) age at the west end of the Island of Orleans, and with the typical Hudson River rocks to the north of the city. The equivalents of the citadel rocks, as seen on the south side of the St. Lawrence River on Gaspé peninsula (see "Report of the Geological Survey," 1881-82), are, by a fault, brought in contact with Silly rocks also; and the limited outcrops of these at Etchemin, on Crane Island, and at several other points, show a precisely similar arrangement.

The principal stratigraphical evidence bearing on the age of these rocks of Quebec City must, then, I take it, be looked for elsewhere. In the southern part of the province about Lake Memphremagog, graphitic shales containing graptolites, described by Lapworth as similar to those from Quebec City, also occur. These are in connection with certain gray and blackish slates and limestones which are an integral part, in so far as we can determine, of the series of slates and limestones which have been already described as Lower Trenton, or possibly Upper Chazy. The statement in Lapworth's paper, published in the "Transactions of the Royal Society of Canada," pp. 171 and 175, seems to be very clearly confirmed; and, from all the evidence at present in our possession, I can see no reason for changing the statement made in my report on this section ("Geological Survey Report," 1887-88, pp. 83, 84, K); viz., that these rocks represent a peculiar development of strata of Trenton age, and probably even down in that formation.

R. W. ELLS.

Ottawa, Dec. 16.

REFERRING to the article on the above subject in your issue of Dec. 5, I may say that Mr. Ami should have restricted his observation to paleontological facts; and the appropriate heading would have been, "On the Paleontology," etc., not "On the Geology of Quebec." As it stands, the article is an instance of what I have elsewhere designated "paleontological stratigraphy."

I was, I believe, the first to point out in 1876-77, and purely on stratigraphical evidence, the fact that the rocks of Quebec City were not, as mapped by Sir William Logan, Levis, but that they were certainly the extension of those on the north shore of Orleans Island, described on p. 200 of the "Geology of Canada" (1863) as Hudson River, and contain certain fossils, figured and described on the same page. I at the same time, 1877-78, traced out, and

delineated on the map, the approximate course of the fault which cuts off the Levis formation, with its characteristic fauna, from the north side of the river. At that time no fossils had been found in the rocks of Quebec City, though mapped as part of the Levis formation (see *Geology of Canada*, 1863, p. 200); but, having determined by close and careful stratigraphical observation what these rocks were, I sent our collector, Mr. Weston, to Quebec to seek for the fossils, which I felt confident must be there, I told him, and that they would prove to be the same as those of Orleans Island, north shore. As Mr. Ami states, some forty or fifty species have since been found by Mr. Weston and others in these rocks. Some of them are from conglomerate bands, and therefore, like some of those in the Levis conglomerates, may be derived from older strata. Mr. Ami says these strata cannot be referred to the Lorraine nor to the Utica, but he fails to give any sufficient reason for this positive assertion. He then states Sir William Logan's opinion, but does not state mine, though he admits, without saying by whom it was determined, the equivalency of the shales on the north shore of the Island of Orleans with the Quebec City rocks. He still wants to separate the rocks at Montmorency Falls, which he, following Logan and myself, now recognizes as Utica, Hudson, or above the Trenton. The structure is diagrammatically shown in my section (*Descriptive Sketch*, p. 14) and in Logan's section (*Geology of Canada*, 1863, p. 234). The two sections are practically alike, and I believe are in a general sense correct. There is not a particle of stratigraphical evidence of any break between Montmorency and the Island of Orleans; but there is much folding, the result probably of the faults 1 and 2, — a slide down and a shove up respectively (see Fig. 1 in *Descriptive Sketch*). Mr. Ami's contention is based solely on his own determination of certain very imperfect specimens of fossils. These determinations may or may not be correct. They do not agree with Logan's (*Geology of Canada*, 1863, p. 200). Ami omits from his list *Eraptolithus bicornis*, *pristis*, and *ramosus*, stated to be Utica-Hudson species (I believe these do occur in Mr. Ami's lists, but under new names). But, even suppose Mr. Ami's determination to be correct, it would not in the least change my opinion as regards the position, in what we call the Cambro-Silurian system, of these rocks; viz., that they constitute a part of the great Calcic bituminous shale formation which overlies the Trenton limestone, and which is known as Utica and Hudson, or Utica-Lorraine, or Cincinnati group, and which has nowhere, from the Lower St. Lawrence to Lake Superior and Wisconsin, ever been seen beneath the Trenton.

I cannot see my way to construct a map or a section, having regard to the known stratigraphical facts, which would bring the Quebec City rocks below the Trenton; nor do the fossils (see lists in *Annual Report of the Geological Survey of Canada*, vol. iii, part 2, pp. 77 K to 81 K) seem to point in that direction, such as *Asaphus* (Canadian?), *Trinucleus*, *Leptaena sericea*, and the graptolites above named (*bicornis*, *pristis*, and *ramosus*). I see no reason for Mr. Ami's remarks about the name "Hudson River," or that there ever was any confusion in its use. The name and the equivalent terms — Lorraine or Cincinnati — are well known, and have always been applied to formations above, or supposed to be above, the Trenton, and below the Medina. The only confusion has been in defining the areas occupied by these formations.

There are, in connection with the old Quebec group area from Vermont to Cape Rosier, still a few doubtful points: 1. The question whether the rocks of Cape Diamond and Quebec City are above or below the Trenton limestone, i.e., Utica, Hudson, or Chazy; 2. The question whether the group of strata originally designated by Logan as "The Magnesian Belt," and by myself as the "Volcanic Group," which include the serpentines, with asbestos and other altered igneous rocks, are Upper Archæan or Lower Cambrian. No fossils have yet been found in any of the strata of this group; but from other considerations, physical, lithological, and stratigraphical, I am inclined to think they are pre-Cambrian, and about the age of the upper part of what we designate "Huronian" in the Lake Superior region.

ALFRED R. C. SELWYN.

Ottawa, Can., Dec. 16.

### Study of the Surface-Markings of the Planets in 1890.

THE progress of astronomy during the year 1890 has been noteworthy in many ways. Some of the important particulars will be given briefly in the references that follow.

The study of the surface-markings of the planets has had a leading place in the work of astronomers giving special attention to observation of this kind. The most startling announcements that have appeared this year are those made by the distinguished Schiaparelli of Milan, Italy, concerning the rotation periods of the planets Mercury and Venus. The first publication of this wonderful discovery, that we know of, was made Dec. 8, 1889, in a public address by Schiaparelli, before the Accademia dei Lincei of Rome, in a special sitting, attended by the King and Queen of Italy.

The discovery was by no means accidental. It was made in the usual way of determining the rotation time of a planet, and that was by observing spots on the surface; and the conclusion reached is, that the rotation time of the planet Mercury is the same as its period of revolution around the sun, its axis being nearly perpendicular to the plane of its orbit. The markings were faint, said to be exceedingly difficult to observe, and Schiaparelli has also found the same thing to be true in regard to the rotation of the planet Venus.

M. Perrotin, director of the observatory at Nice, made a series of observations on the markings of the planet Venus for seventy-four days between May and October, for the purpose of testing for himself Schiaparelli's results. His conclusion is, that the rotation time of the planet Venus does not differ from the time of revolution around the sun more than thirty days, making its time of rotation somewhere between one hundred and ninety-five and two hundred and twenty-five days. He also finds that the axis of the planet is almost perpendicular to the plane of its orbit. The displacement of the white region, observed at the northern edge of the terminator, indicates a difference not to exceed fifteen degrees, as was admitted by Schiaparelli. This important work materially strengthens the views of Schiaparelli.

Coming nearer home in our study of the surface-markings of the planets, it should be mentioned that the change of latitude, or the variation of latitude on the earth's surface, should be mentioned as a question of much interest in scientific periodicals for the year 1890. Significant and unexplained results are found in the records of some of the oldest observatories in the world that indicate a change in latitude.

At a meeting some time ago, the International Geodetic Association discussed this important question; and at another soon to be held, if deemed wise, plans will be made to undertake an extended series of observations by observatories in both hemispheres, for the purpose of determining whether or not the latitude of a place is constant, or a variable quantity. Professor Porro of the Royal University of Turin is much interested in pushing this work forward.

In this country the study of the markings of the planet Mars for the last year received as much, if not more, careful attention by Professor W. H. Pickering of Harvard College Observatory than by any one else. Although the last opposition was not a favorable one for the delicate and severe work required of one who can observe the "canal" system of Mars, it gives us pleasure to record what he did. His work was by photography at Mount Wilson, California, and by visual observation at Cambridge, Mass., using the Boyden 12-inch refractor.

His attention was directed to two points,—the colors exhibited by the planet, and the finer detail upon the surface. In regard to surface delineation, he thinks that Green's map gives much the best idea of the appearance of the planet, and the general shape of the details, of any thing yet published; and still his observations at Cambridge give considerable fine detail not shown on Green's map, all of which agrees more or less with that reported by Schiaparelli. Professor Pickering regards the name "canal" as a very unfortunate term by which to designate the strange surface-markings, because there is not the slightest evidence to support the supposition that they are filled with water: on the contrary, such a view is a very improbable one. Though he can see a large

part of this surface delineation, he is not able to see the markings called "canals" double, as described by Schiaparelli. He deservedly expressed great admiration for the patient study and the keen eye of the astronomer who could discover details of Mars with an eight-inch telescope, because of the great difficulty of seeing them with larger instruments when their places and characters are known. During the present year Schiaparelli has reviewed his former work on the study of Mars' surface; and a report of the same appears, by Dr. F. Terby of the Academy of Belgium, in the November number of *L'Astronomie*. This late account of the work of the original discoverer is important, in that it confirms his former results, and adds to them interesting details in regard to the apparent widening of some of the canals, and the apparent change of duplicity in the different parts of the same canals at different times. This report will be read with great interest, because it strongly confirms Schiaparelli's former views, which have been cautiously entertained by astronomers generally.

The most interesting work on the detailed study of Jupiter during the past year is by J. E. Keeler of the Lick Observatory. His drawings, made by the aid of the 33-inch equatorial during the months of July and October, are most excellent specimens of sharp delineation in variety of detail. The fine shading of the belts, the Great Red Spot in distinct outline, with the broken bands veering in latitude as they pass the spot, the round white spots, the oblong dark spots tinged with red at the bottom, and the satellite and its shadow in transit, are some of the very interesting features of Jupiter's surface-markings which Mr. Keeler has put on record in these drawings. The new features about the oval spots are their shape and red color at the base. By other observers they have been spoken of as round, and we do not recall that others have noticed the color which they all show at the bottom. This is doubtless due to the superior power of the Lick telescope. Taking into account the fact that Professor Young has seen a veiling of the Great Red Spot,—something like a white film over it, if we understand his words,—and the views of Mr. Keeler shown in his drawings, where the dense dark clouds are bent about it as they pass it, and something of the same color as that of the Great Spot seen at the base of the dark oval spots on the other side of Jupiter's equator, it seems as if signs of important changes in the surface character of the giant planet are constantly going on before our eyes from year to year.

We are sorry that Mr. Keeler's fine drawings have not been published in this country. They have nearly all appeared in foreign scientific journals.

WM. W. PAYNE.

Carleton College Observatory, Dec. 16.

### Snake Hill, N.J., as a Locality for Minerals.

BEING told that there had been some crystals found at Snake Hill, N.J., early in 1888 I started out, accompanied by a young mineralogist, and traversed a road leading across a marsh to the hill, for a distance of five miles. We sought out the quarry where the convicts from Hudson County are educated in the art of blasting. It is about a hundred feet high, and overlooks the Hackensack River.

The hill is an ejection of trap, surrounded by sandstone, the rock being used in macadamizing the county roads. We found several veins of minerals running across the quarry.

The principal minerals which we found and classified are datholite in fine glassy crystals; pectolite in long aggregations of crystals, some exceeding three inches in length and in fibrous radiations; laumontite in fine, needle-like crystals; prehnite in small balls of a beautiful green color; natrolite in fine glassy aggregations of fibrous crystals; analcite in excellent trapezohedrons, some of which measured nearly one inch across; apophyllite in fine transparent square octahedrons, prisms, and tables; gmelinite in excellent aggregations of pink crystals, rhombohedral in form, and modifications of the same, some of which were three-quarters of an inch across; stilbite in prismatic crystals and acicular aggregations of brown and white color; heulandite in brownish rhomboidal crystals; calcite, massive, of white, yellow, and green colors, and dog-tooth crystals of yellow color. There were many

other crystals and massive specimens found, but either very small or insignificant in regard to quality or quantity.

I expect this place to be to the mineralogist what its near neighbor, Bergen Hill, world-famed, was fifteen years ago.

E. W. PERRY.

#### Color-Changes in Toads.

IN Mr. Poulton's "Colors of Animals" he mentions (p. 33) that "the common frog can change its tints to a considerable extent." This recalls some experiments made in 1876 on common toads. Toads kept on dark grounds or in dark pen became dark, and on light grounds or in light pen became very much lighter in color. The arrangement of colors was not changed, but the whole seemed to grow lighter or darker. Red, blue, or other colors seemed to have no effect except as to their value as light-absorbers. Owing to the detailed notes being mislaid at this writing, it is impossible to give details of time; but my remembrance is that the change of shade took much longer than Mr. Poulton quotes for the frog. The experiment is an easy and interesting one to try. In fact, there is an immense field for young investigators in the question of color, because of the ease with which apparatus can be arranged and the number of species which as yet have not been tested. It is partly for this reason I record the above on toads.

FREDERIC GARDNER, Jun.

Trinity College, Hartford, Conn., Dec. 17.

#### The Cause of Rain.

IN your issue of March 7, I refer, on p. 161, in a letter with the above title, to certain experiments which to my mind show conclusively that condensation takes place in saturated air by compression, and not by expansion.

As far as I am able to ascertain, the rain theories which my letter brings me in opposition to are based upon the supposition that the results of compressing and expanding saturated vapor or steam, as mentioned in the mechanical theory of heat, may be directly applied to saturated air.

That these two so entirely different substances — the one a pure gas, and the other a compound or mixture of various gases, and both containing the same quantity of aqueous vapor for equal temperatures, pressures, and volumes — should act in the same way under compression and expansion seems to me hardly credible, and it may therefore be of interest to inquire whether any of your readers can quote the results of experiments on saturated air which are contrary to those I have arrived at.

FRANZ A. VELSCHOW, C.E.

Brooklyn, N.Y., Dec. 20.

#### BOOK-REVIEWS.

*A Treatise on Electro-Metallurgy.* By WALTER G. McMILLAN. London: Charles Griffin & Co.; Philadelphia, J. B. Lippincott Company. 12°. \$3.50.

THIS volume treats of the application of electrolysis to the plating, depositing, smelting, and refining of metals and to the reproduction of printing surfaces and art work, etc. That the author was well equipped for his work is evident to all who, with some understanding of the subject, glance through even a single chapter of the book. He believes evidently that in writing upon such subjects a technological rather than a technical treatment is required, for the matter is so lucidly set before the reader, that, even though he be a novice, he will have no difficulty in comprehending; and this result is achieved without the use of technicalities, which, though useful in their proper place, are sometimes confusing to the general reader, and unnecessary for the expert. Still, in cases where the success or failure of a process is largely governed by strict attention to minute details, the author has not hesitated to introduce such instructions as may be needful to guide the worker in the right direction. In other words, the treatise is just such a combination of theory and practice as might be expected from one who, in addition to a knowledge of both sides of the subject, possessed the happy faculty of imparting that knowledge to others, as far as may be done through the medium of a book.

The first chapter is mainly historical, briefly sketching the

progress of the art, from the rude beginnings of its chemical side, when it was discovered by the ancients that "certain metals became superficially coated with other metals when plunged into suitable solutions," down to its latest developments, not omitting the much-discussed Elmore process of producing seamless copper tubes. In this chapter the scope of the art of electro-metallurgy is stated to be, (1) to obtain a coherent and removable deposit on a mould the form of which it is desired to reproduce with accuracy, — electrotyping; (2) to obtain a thin but perfect and adhesive film of metal upon a metal of different character, in order to impart to it properties in which it is naturally deficient, — electroplating; (3) to obtain the whole of a given metal from a substance containing it, either as a substitute for extraction by smelting, or for analytical or refining purposes; and (4) to dissolve metals, — either to remove an existing coat of one metal from the surface of another, or to effect the complete or partial solution of a homogeneous body superficially, as in electro-etching. This statement will give a good idea of the scope of the treatise.

As a fair knowledge of chemistry and electricity is necessary to those who would understand the subject, the author introduces a chapter dealing in an elementary fashion with those sciences; not intended, of course, to take the place of text-book and laboratory study, but rather to lead up to it. The book is fully illustrated, and, in addition to a good index, has a glossary of substances commonly employed in electro-metallurgy, and many useful tables.

*Outings at Odd Times.* By CHARLES C. ABBOTT, M.D. New York, Appleton. 16°. \$1.50.

To those acquainted with Dr. Abbott's previous works, this little volume needs no introduction. In spirit, if not in book-making sequence, it is one of a series of which, we trust, the end is not yet. To the nature-loving naturalist, not the perfunctory one, the reading of it will necessarily be a pleasure and an assistance; to the city dweller, with an occasional "day off," at any season of the year, it will prove an incentive to recreation-seeking in the best direction; to the average dweller in the country it will act as an "eye-opener" to much that is going on about him; while to any reader of ordinary intelligence the perusal of it cannot fail to be beneficial. It is the record of what a true lover of nature, in all its phases, has seen, heard, felt, and thought about on occasional outings at odd times, in odd places, and under what may be called odd circumstances. Beginning with a winter sunrise, and the midwinter minstrelsy of the birds that may be heard along the Delaware even when the snow covers the ground, he carries the reader around the cycle of the seasons, dwelling upon the pleasures that may be indulged in out of doors at almost any time, and even in the most unpromising of places. Moreover, there is much sound though unobtrusive philosophy in the book.

*Dust and its Dangers.* By MITCHELL PRUDDEN, M.D. New York, Putnam. 16°. 75 cents.

DR. PRUDDEN's interesting little volume, "The Story of the Bacteria," is followed by another of equal interest and value. It has been written "with the purpose of informing people, in simple language, what the real danger is of acquiring serious disease — especially consumption — by means of dust-laden air, and how this danger may be avoided." The plan is well carried out, and the book will open the eyes of the people without needlessly alarming them. Chief attention is given to the consideration of the organic — bacterial and mould — constituents of dust-laden air. The "plate method" of biological analysis of air — i.e., five minutes' exposure to the air of a film of nutrient gelatine, and subsequent growth of colonies from the germs deposited — is simple and reasonably accurate, and yields interesting results. The relative numbers of bacteria in the air of the library of a private house, of a large retail dry-goods store, and of a cross-street in process of being cleaned, were 34, 199, and 3,810. Under ordinary conditions, a New Yorker takes into his body with every twenty breaths 11 to 376 bacteria and moulds; and, when the dust is being stirred up, the number is excessive. The most of these are not disease-germs, but some may be so. Thanks to the ciliated cells of the air-passages, the phagocytes, the lymph-glands, and the digestive processes, the organic and inorganic dust-particles are

mostly well disposed of. But some of the germs may find the proper soil, multiply, and cause disease. Of such diseases, consumption is by far the most deadly, and the one most easily spread, since the germs are being constantly scattered in the sputum in streets, public buildings, and public conveyances. Consumption is, however, preventible, and to this end the destruction of the sputum would distinctly tend. The author's severe strictures of the street-cleaning department are fully justified. "We virtually condone manslaughter just as long as we permit men to hold municipal offices who fail in their plain duty in the protection of the public health."

Germ-laden dust readily finds its way into private rooms: hence, after sweeping, the furniture and floor should be cleaned, not dusted. "Dust and its Dangers" is an excellent, suggestive, and temperate little book.

#### AMONG THE PUBLISHERS.

AMONG the features of *Outing* for January, 1891, are "Artificial Skating Ponds," by C. Bowyer Vaux, who teaches our boys how nature can be "coached" into the skater's service; and "Sailing on Skates," and the method of rigging up such an outfit.

—The D. Van Nostrand Company of this city have published, in a neat octavo of a hundred pages, a work on "Maximum Stresses under Concentrated Loads, treated Graphically," by Henry T. Eddy, C.E., Ph.D., professor of mathematics and civil engineering in the University of Cincinnati. It is a reprint from the "Transactions of the American Society of Civil Engineers," and is illustrated by twenty-five figures in the text and one folding plate. The object of the work, as stated by the author, is to introduce a new graphical method for determining what position a moving train of wheel weights must have in order to produce the greatest stress in any given part of the bridge truss or girder over which the train is passing. The method proposed depends princi-

pally upon the construction and use of a class of polygons or curves named by the author "re-action polygons." These are readily constructed graphically, and their properties are such as to give with ease the train positions for maximum stresses as well as to decide which one of several maxima is the greatest. The proof of these constructions is given in algebraic form, the graphical constructions being really only representations of the algebraic conditions for maximum stresses. The treatise shows how the algebraic theory leads to convenient graphical solutions of the equations of condition for maximum stresses, and will prove a serviceable addition to the growing literature of bridge engineering.

—In *The Chautauquan* for January, 1891, may be found "The Intellectual Development of the English People," by Edward A. Freeman; "The English Constitution," IV., by Woodrow Wilson; "England after the Norman Conquest," Part I., by Sarah Orne Jewett; "The English Towns," by Augustus I. Jessopp, D.D.; "Studies in Astronomy," IV., by Garrett P. Serviss; "How the People are Counted," by H. C. Adams; and "Plants in Legends," by Dr. Ferd.

—The American Book Company have just published "Greek for Beginners," by Edward G. Coy, professor of Greek in Phillips Academy. It is intended to be a companion book to the Hadley-Allen "Greek Grammar," and to be used as an introduction to either Coy's "First Greek Reader" or the *Anabasis of Xenophon*. A book bearing the same title, prepared by Professor Joseph B. Mayor, was published in London in 1869. An American edition of that book, considerably altered in form, was published in 1880 as "Coy's Mayor's Greek Lessons." The book now issued is a revision of the last-named edition, but the changes introduced by Professor Coy are so numerous and extensive, that, in justice to both Professor Mayor and himself, he has deemed it advisable to assume the entire responsibility for the work. He has therefore

JUST PUBLISHED. 8vo, \$4.00.

## THE MYOLOGY OF THE RAVEN

(*CORVUS CORAX SINUATUS*).

A GUIDE TO THE STUDY OF THE MUSCULAR SYSTEM IN BIRDS. By R. W. SHUFELDT. With numerous illustrations. 8vo, \$4.00.

"We can congratulate Dr. Shufeldt on the production of an original and well-arranged text-book, the result of much patient labour in collecting and dissecting, and careful thought in arrangement. The volume will appeal especially to ornithologists, as well as to students of comparative anatomy. The figures, of which there are 76, are on the whole excellent, and with few exceptions are original. A copious bibliography and index are given at the end of the book."—*NATURE*.

SUBSCRIBE NOW FOR THE YEAR 1891.

## NATURE:

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE. Weekly, price, 15 cents. Annual Subscription, \$6.00. Sent two months as a trial subscription on receipt of \$1.00.

"NATURE is recognized everywhere as the foremost scientific journal, of a general character, in the world."—*N. Y. EVENING POST*.

"The one journal indispensable to students in every branch and every land."—*Popular Science Monthly*.

"That NATURE has completed its twentieth year is subject of congratulation on the part of the whole scientific world."—*Evening Post*.

**Tycho Brahe.** A picture of scientific life and work in the sixteenth century. By J. L. E. DREYER, Ph.D., F.R.A.S. With illustrations. 8vo, \$3.50.

"A most valuable contribution to the history of mediæval astronomy; it is creditably exempt from slips and inaccuracies of memory, pen or print; abounds with bibliographical knowledge and indications; and—not its least merit—is furnished with a highly serviceable index. It portrays, moreover, with perfect candour, yet full comprehension and sympathy, a vigorous and picturesque individuality."—*Nature*.

**The Meteoritic Hypothesis.** A statement of the results of a spectroscopic inquiry into the origin of cosmical systems. By J. NORMAN LOCKYER, F.R.S., etc., etc. With numerous illustrations. 8vo, \$5.25.

**Macmillan's Physical and Political School Atlas.** A series of eighty maps with general index. By J. G. BARTHOLOMEW, F.R.S.E., F.R.G.S. \$3.00.

**Are the Effects of Use and Disuse Inherited?** An Examination of the views held by Spencer and Darwin. By WILLIAM PLATT BALL. 16mo, \$1.00.

"The questions dealt with in Dr. Ball's clearly reasoned and ingenious little book, are not merely interesting from a speculative point of view, but upon their solution depend social problems of the first importance. The views set forth by the author coincide in large measure with the theory of heredity advanced by Weissman and other recent investigators."—*N. Y. Tribune*.

MACMILLAN & CO.,

112 Fourth Avenue, New York.

dropped Professor Mayor's name from the titlepage, although acknowledging his indebtedness to that gentleman's book. The distinctive features of the work as now presented consist in its "building-up a boy's knowledge of Greek upon the foundation of his knowledge of English and Latin," and in the fact that "no Greek words have been used in the earlier part of the book except such as have connections either in English or Latin."

—Among the recent publications received from the United States Coast and Geodetic Survey Office is "Appendix No. 8, Report for 1888 (90 pp. sketch), entitled Geodesy. Geographical Positions in the State of Connecticut. Prepared for publication by Charles A. Schott, assistant." This collection of geographical positions, and of geodetic data resulting, is made in continuation of the scheme of publishing the results in those States where the field-work of the triangulation is substantially completed, and where the triangulation could be made to rest on the standard data of the survey.

—An interesting paper by Professor von Hofmann, upon the dissociation of carbon dioxide gas into carbon monoxide and oxygen by means of the electric spark, is referred to in *Nature* of Dec. 4. Dalton and Henry long ago showed that carbon dioxide, although formed by exploding a mixture of two volumes of carbon monoxide with one volume of oxygen by the passage of an electric spark, is again partially decomposed into carbon monoxide and oxygen by the continued passage of the spark. This dissociation, however, is very slow, and usually incomplete. Hofmann and Buff, in the course of their well-known work upon gaseous re-actions, further showed that "the electric spark passes through carbon dioxide with a violet glow, producing at first a rapid increase in the volume, which, however, becomes less and less marked until at the expiration of about half an hour the separated carbon monoxide and oxygen recombine with a sudden explosion, the re-formed carbon dioxide at once commencing to be

again dissociated." Deville and Berthelot afterwards investigated the same phenomena, and also found that the re-action was never complete, proceeding only until about 28 or 29 per cent of the carbon dioxide was decomposed, but they never observed any explosive recombination as described by Hofmann and Buff. Professor Hofmann has therefore determined the exact conditions under which the explosive recombination occurs. It certainly appears somewhat remarkable that the same spark can effect both dissociation and recombination; yet such, within the limits described in the memoir, is an actual fact. The first essential point to be observed is the length of path of the spark. The most suitable distance apart of the platinum terminals appears to be between two and a half and three millimetres, and Professor Hofmann advises the use of adjustable terminals rather than the ordinary platinum wires fused into the side of the eudiometer. A Leyden jar in the circuit renders the occurrence of periodical explosions more certain. The spark should also pass at about a quarter the height of the gas column, instead of, as usual, near the top. The current itself, moreover, should not be too strong: that from two Bunsen cells and only a moderate sized Ruhmkorff coil is quite sufficient, and yields the best results. It is also preferable to use a volume of carbon dioxide, previously dried over oil of vitriol, not exceeding ten cubic centimetres at a pressure of 650–700 millimetres: eight cubic centimetres give excellent results. Under these conditions, the first explosion usually occurs in from fifteen to twenty minutes, and sometimes earlier. The flame commences in the neighborhood of the spark, and then perceptibly spreads through the whole length of the gas column. It is colored blue in the first explosion, and green in the succeeding ones, owing to the volatilization of a little mercury vapor. The second and succeeding explosions occur after shorter intervals than the first. This experiment is certainly one of the most interesting in all the range of dissociation phenomena; and full details, with drawings of the apparatus, are given by Professor Hofmann in his memoir.

# Dyspepsia

## Horsford's Acid Phosphate.

In dyspepsia the stomach fails to assimilate the food. The Acid Phosphate assists the weakened stomach, making the process of digestion natural and easy.

Dr. R. S. McCOMB, Philadelphia, says: "Used it in nervous dyspepsia, with success."

Dr. W. S. LEONARD, Hinsdale, N. H., says:

"The best remedy for dyspepsia that has ever come under my notice."

Dr. T. H. ANDREWS, Jefferson Medical College, Philadelphia, says:

"A wonderful remedy which gave me most gratifying results in the worst forms of dyspepsia."

Descriptive pamphlet free.

Rumford Chemical Works, Providence, R. I.]

Beware of Substitutes and Imitations.

**CAUTION.**—Be sure the word "Horsford's" is printed on the label. All others are spurious. Never sold in bulk.

## VENTILATION

dilutes, but produces draughts, "a remedy worse than the disease."

Every home has its sources of poison. Polluted air is ever present, and cannot be removed in the ordinary way, but by using the

### SHERMAN "KING" VAPORIZER

every germ of disease and decay can be neutralized, and every offensiveness removed.

Simple, Self-Acting, Inexpensive, it will insure

## PURIFICATION

CONTINUOUS AND  
ABSOLUTE



MEANS HEALTH, VIGOR,  
VIVACITY, GOOD MORALS.

Illustrated Pamphlet Free. Address

LYON M'F'G CO.,

59 FIFTH AVENUE, NEW YORK,

Sole Agents for the World.



The Cod  
That Helps to Cure  
The Cold.

The disagreeable  
taste of the  
COD LIVER OIL  
is dissipated in

# SCOTT'S EMULSION

Of Pure Cod Liver Oil with  
HYPOPHOSPHITES  
OF LIME AND SODA.

The patient suffering from  
**CONSUMPTION,  
BRONCHITIS, COUGH, COLD, OR  
WASTING DISEASES,** may take the  
remedy with as much satisfaction as he  
would take milk. Physicians are prescribing  
it everywhere. It is a perfect emulsion,  
and a wonderful flesh producer. Take no other

JUST PUBLISHED.

POPULAR MANUAL OF VISIBLE SPEECH AND  
VOCAL PHYSIOLOGY.

For use in Colleges and Normal Schools. Price 50 cents.  
Sent free by post by

N. D. C. HODGES, 47 Lafayette Pl., N. Y.

Readers of Science

Corresponding with or visiting Advertisers  
will confer a great favor by mentioning the paper.



## CALENDAR OF SOCIETIES.

## Philosophical Society, Washington.

Dec. 20.—Annual Reports of the Treasurer and Secretaries, and election of officers for the year 1891.

## The Anthropological Society, Washington.

Dec. 16.—Robert Fletcher, The Vigor and Expressiveness of Older English.

## Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the "Want" inserted under this head FREE OF COST, if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

**WANTED.**—A young man wishes a position as instructor in the sciences in some school or college. Chemistry a specialty. Would like to hear of some position with a private or manufacturing chemist, in which his knowledge of chemistry would help him. Address E. E. TOWNE, B.A., 272 Worthington St., Springfield, Mass.

**WANTED.**—An Exploring Expedition, backed by \$15,000, will be sent into Alaska and the British Northwest Territory the coming year, to be gone one or two seasons. A scientist or two will more than likely be taken along. Applications from such will be gladly received and carefully considered. To assist in making these applications the commander would say that he considers a full practical knowledge of mineralogy and geology necessary, and if the applicant can add the duties of botanist, ethnologist, or any other of the sciences, and photography, sketching, medicine and surgery, or other useful arts for exploring, it will add to the chances of being selected. Applicants must be physically perfect, and ought to be about medium age. One of these scientists will be the second in command of the party. Any credentials forwarded for consideration will be returned, if requested, after consideration. Address "ALASKA," care of *Science*.

**WANTED.**—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1833, Grinnell, Iowa.

**WANTED.**—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P. O. Box 224, care Prof. F. C. Van Dyck.

**COULD** some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Scharf Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

## Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1800 Seeger and Guernsey Cyclopaedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost \$6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of *Unios alatus*, *trigonus*, *parvus*, *occidens*, *anadontoides gibbosus*, *rectus*, *verucosus*, *gracilis coccineus*, *ventricasus*, *multiplicatus* and *plicatus cornutus*. *Margaritana confrogosa*, *complanata*, *rugosa*. *Anadonta edentula*, *decora*, *corpulenta*, and about 300 of the beautiful *Ana suborbiculata*. Wanted: *Unios* from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.

**BOOKS:** How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 47 Lafayette Place New York.

JUST PUBLISHED.  
HOUSEHOLD HYGIENE.

BY MARY TAYLOR BISSELL, M.D., NEW YORK.

12°. 75 cents.

"This little volume has been compiled with the hope that the housekeeper of to-day may find in its pages a few definite and simple suggestions regarding sanitary house-building and house-keeping which will aid her to maintain in her own domain that high degree of intelligent hygiene in whose enforcement lies the physical promise of family life" (author's preface).

## TIME RELATIONS OF MENTAL PHENOMENA.

BY JOSEPH JASTROW, PROFESSOR OF PSYCHOLOGY AT THE UNIVERSITY OF WISCONSIN.

12°. 50 cents.

It is only within very recent years that this department of research has been cultivated; and it is natural that the results of different workers, involving variations in method and design, should show points of difference. In spite of these it seems possible to present a systematic sketch of what has been done, with due reference to the ultimate goal as well as to the many gaps still to be filled.

N. D. C. HODGES, 47 Lafayette Place, NEW YORK.

THE WINNIPEG COUNTRY;  
OR,  
ROUGHING IT WITH AN ECLIPSE PARTY.

BY  
A. ROCHESTER FELLOW.  
(S. H. SCUDDER.)

With thirty-two Illustrations and a Map.  
12°. \$1.50.

"The story is a piquant, good-humored, entertaining narrative of a canoe voyage. A neater, prettier book is seldom seen."—*Literary World*

"This is a sprightly narrative of personal incident. The book will be a pleasant reminder to many of rough experiences on a frontier which is rapidly receding."—*Boston Transcript*.

"The picture of our desolate North-western territory twenty-five years ago, in contrast with its civilized aspect to-day, and the pleasant features of the writer's style, constitute the claims of his little book to present attention."—*The Dial*.

N. D. C. HODGES, PUBLISHER,  
47 LAFAYETTE PLACE, NEW YORK.

"The Corner Stone of a Nation."—*Longfellow.*



## PLYMOUTH ROCK.

Have you stood on the world famous "Plymouth Rock," or visited the historic scenes in Pilgrim-land? Would you do this in picture and story, send for one of the following books:

**Glimpses of Pilgrim Plymouth.**—Forty-eight views in Photo-Gravure from photographs and paintings, with descriptive text, showing the Plymouth of 1620 and the Plymouth of today. Price by mail, \$1.50. Reduced size, thirty-four views, 50 cents.

**Sketches about Plymouth.**—Etchings by W. H. W. Bicknell, in white portfolio. Size, 10x12. \$2.50.

**Pilgrim Plymouth.**—Sixteen Indotype views, with descriptive text. Size, 10x13. Cloth covers, gilt, \$4.50. Same, in handsome seal binding, \$7.50.

**Standish of Standish.**—by Jane G. Austin. The story of the Pilgrims; deeply interesting, historically accurate; cloth binding. \$1.25.

**Little Pilgrims at Plymouth.**—By L. B. Humphrey. The Pilgrim story told for children. Finely illustrated; cloth. \$1.25.

**Plymouth Rock Paper Weights.**—Models of the famous Rock, two sizes; by mail 35 and 50 cents each.

**Gov. Carver's Chair.**—Models of the Chair brought in the Mayflower, 1620, 25 cents.

**Photographs of Plymouth Rock.**—Pilgrim Hall, National Monument to the Pilgrins, and one hundred other subjects of historic interest. Extra fine views, 5¼x8½, 35 cents each, \$4.00 per dozen. Catalogue free.

**Plymouth Albums, 31 Views,** 25 cents.

Any of the above books will make handsome Christmas and Birthday presents, and will be mailed postpaid on receipt of price.

We have sent samples to the editor of this paper who will vouch for their excellence.

Agents wanted.

A. S. BURBANK,  
Pilgrim Bookstore, Plymouth, Mass.

## OF WHAT USE IS THAT PLANT?

You can find the answer in

## SMITH'S "DICTIONARY OF ECONOMIC PLANTS."

Sent postpaid on receipt of \$2.80. Publisher's price, \$3.50.

SCIENCE BOOK AGENCY,  
47 Lafayette Place, New York.

A Handsome and Useful Present that will be Appreciated  
by all who write.

## THE HULIN FOUNTAIN PEN.

Warranted 14 Karat Gold and to give perfect satisfaction.

Hundreds of Testimonials received from pleased customers, who say that the  
"HULIN" is the best Fountain Pen in the market.

Price, \$1.50, \$2.00, and \$2.50 each, according to size selected.

Sent by mail postpaid.

John S. Hulin,

369 Broadway, N. Y.,

Manufacturing Stationer and Steam Printer, and Dealer in Useful Office Specialties and

Labor-saving Devices for Accountants. Headquarters for Wedding

Invitations, Visiting Cards, Typewriters' Materials,

and all supplies in the Stationery Line.

Send Stamp for Illustrated Catalogue.